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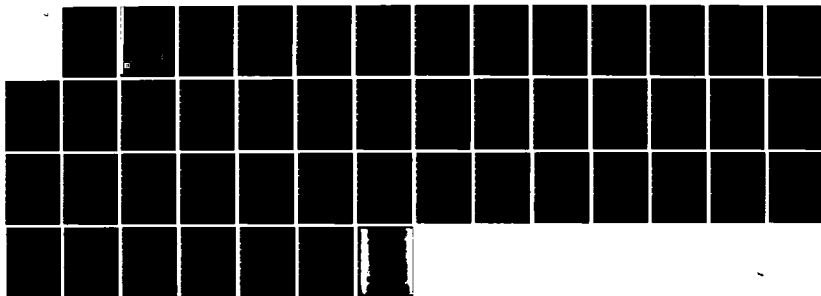
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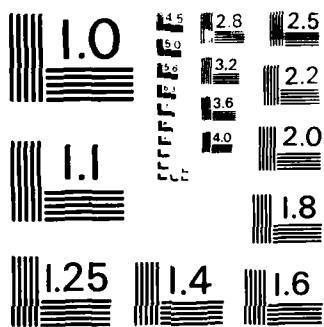
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NORDSEE RADAR BACKSCATTER MEASUREMENTS
DATA REPORT

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NORDSEE RADAR BACKSCATTER MEASUREMENTS
DATA REPORT

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The University of Kansas
Lawrence, Kansas 66045-2969

RSL Technical Report ✓
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March 1984

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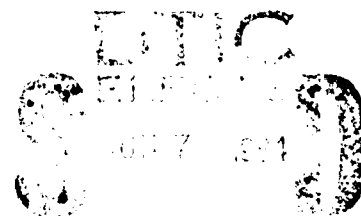
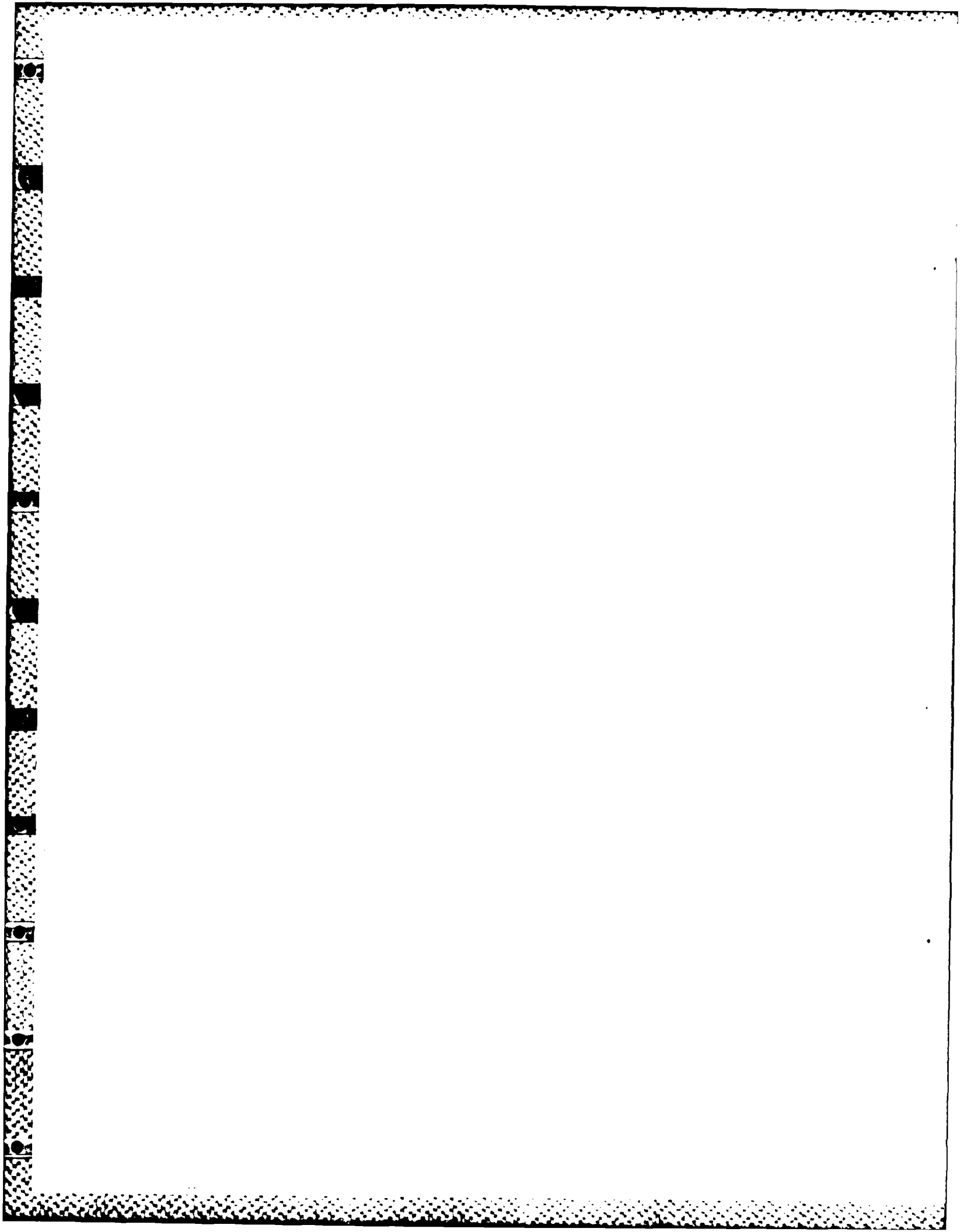


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NORDSEE RADAR BACKSCATTER MEASUREMENTS DATA REPORT

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ABSTRACT

This report summarizes the radar backscatter measurements of the ocean made by the University of Kansas from the Nordsee tower during the period from January 20 through February 3, 1984.

1.0 INTRODUCTION

→ Radar backscatter measurements of the ocean were made by University of Kansas (KU) investigators from the Nordsee tower to determine scattering coefficient as a function of wind speed, incidence angle and look direction at C-, X- and Ku-bands and to determine the modulation of Bragg-resonant ripples by long waves.

A modified version of the KU helicopter-borne scatterometer (HELOSCAT) was used to acquire the data. The radar backscatter data were collected at selected frequencies between 4 and 17 GHz, and incidence angles between 18° and 70° with VV- and HH-polarizations.

The purpose of this report is to summarize the data collected during the experiment. A brief description of the system used for these measurements is given in Section 2.0. Section 3.0 and Appendix I summarize the data. Appendix II is a reproduction of the data log.

2.0 SYSTEM DESCRIPTION

A modified version of HELOSCAT III was used to acquire the radar backscatter from the ocean during this experiment. The system was operated in the laboratories located on the lower deck of the Nordsee tower. The antenna mount was installed on the southeast corner of the lower deck. A microcomputer was used to sample different instruments and record the data on a digital cassette tape.

The relative calibration of the system was performed by measuring the signal from the delay line switched in place of the antenna. The absolute calibration was performed by measuring the power received from targets of known radar cross-section (a metal sphere of 20 cm diameter and a Luneberg lens were used during this experiment). The important specifications of the system used in this experiment are given in Table 1.

TABLE 1
SYSTEM SPECIFICATIONS

Type	FM-CW
Frequency Range	4-17 GHz
FM Sweep	750 MHz
Transmitted Power	5-16 dBm
Intermediate Frequency	50 kHz
IF Bandwidth	13.5 kHz
Antenna:	Log-Periodic Reflector
Polarization	VV, HH
Size	61 cm
Two-Way Effective Beamwidths	5.2°, 2.8° and 2.0° at 5.3, 10, and 15 GHz
Incidence Angles	18° to 70° from vertical
Calibration:	
Internal	Delay line
External	Metal sphere and Luneberg lens
Height	24 meters

3.0 EXPERIMENT SUMMARY

Measurements of the radar backscatter from the ocean were made as part of the ESA C-band wind scatterometer campaign. Facilities and support were provided by German participants.

The primary emphasis in the data collection was to acquire long data runs at a fixed azimuth and incidence angle at 5.3, 10 and 15 GHz with VV-polarization. In addition, during aircraft overflights measurements were made at a fixed azimuth angle and the same incidence angles as that used by the equipment in the aircraft at 5.3 GHz with VV-polarization. The measurements were extended to other frequencies and HH-polarization as much as possible. Internal calibration of the system was performed before and after each data run.

A summary of each data run on a day-to-day basis is given in the tables in Appendix I. Also to be found in Appendix I are the total number of hours of data collected for up-, down-, and crosswind and the names of tapes which contain these data. The wind speed and directions given in the table are averages over an hour.

4.0 CONCLUSIONS

The radar system performed without any trouble during the experiment. A total of 140 hours of data has been collected out of which 65 hours are for upwind, 17 hours are for downwind, and 53 hours are for crosswind, the remaining 5 hours being for internal and external calibration. We believe the data collected will be useful in determining the scattering coefficient as a function of wind speed, incidence angle and look direction, and the modulation transfer function.

APPENDIX I

Total number of hours of data = 140

<u>Wind Direction</u>	<u>No. of hours</u>	<u>Tapes</u>
Upwind	65	4B, 5A, 5B, 6A, 8B, 9A, 10A, 10B, 11A, 11B, 12A, 12B, 13A, 13B, 14A, 14B, 15A, 16B, 17A, 17B, 18A, 18B, 19A, 20B, 21A, 21B, 22A, 22B, 24A, 24B, 25A, 25B, 26A, 26B, 27A
Downwind	17 hrs, 20 min.	1A, 1B, 2A, 2B, 3A, 3B, 4A, 7A, 7B, 8A
Crosswind	53 hrs, 15 min.	6A, 6B, 7A, 8A, 8B, 9A, 9B, 15A, 15B, 16A, 16B, 19A, 19B, 20A, 20B, 21A, 22B, 23A, 23B, 24A

APPENDIX II
Reproduction of Data Log

DATE: Jan 22, 1964

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (knots)	WIND DIRECTION
								Air	Water		
220401	2B	45-77	IC	.							
220402	2B	45-77	VV	45	D	16:27	17:00	-12	3.1	33	130
220403	2B	45-77	IC								
220404	3A	45-77	VV	45	D	17:10	18:00	-11	3.1	37	120
220501	3A	9-17	IC								
220601	3A	9-17	VV	45	D	19:01	20:14	-13	3.2	39	120

DATE: Jan 23, 1964

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO.	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (knots)	WIND DIRECTION (deg)
								Air	Water		
230001	3B	5.3	IC	55	D	9:20	10:00	-18	3.3	27	120
230002	3B	5.3	VV	55							
230003	3B	5.3	IC								
230004	3B	10	IC	55	D	10:40	11:14	-29	3.2	27	120
230005	3B	10	VV								
230006	3B	10.15	IC	55	D	11:16	12:00	-30	3.2	26	120
230007	3B	15	VV								
230008	3B	15	IC								
230009	3B	5.3	IC	48	D	12:40	12:50	-29	3.3	28	110
230010	3B	5.3	VV								
230011	4A	5.3	VV	48	D	12:53	13:20	-29	3.3	28	120
230012	4A	5.3	IC								
230013	4A	10	IC	48	D	13:28	14:18	-20	3.4	28	120
230014	4A	10	VV								
230015	4A	10.15	IC	48	D	14:15	15:00	-28	3.6	27	130
230016	4A	15	VV								
230017	4A	15	IC								
230018	4A	5.3	IC	45°	DU	16:45	17:15	-31	3.6	29	120
230019	4B	5.3	VV								
230020	4B	5.3	IC								
230021	4B	5.3	VV								
230022	4B	5.3	IC								
230023	4B	5.3	IC								

DATE: Jan 24, 1964.

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (°)
								Air	Water		
240403	6A	5.3	IC	55	U	9:48	10:55	0.1	3.2	36	80
240404	6A	5.3	VV	55	U	10:32	11:04	0.2	3.2	28	70
240501	6A	5.3	VV								
240502	6A	5.3	IC								
240503	6A	10.15	IC	55	U	11:07	11:19	0.2	3.2	27	70
240504	6A	10	VV								
240601	6A	10	IC								
240602	6A	15	IC								
240701	6A	15	IC	55	C	12:50	13:36	0.6	3.1	26	70
240702	6A	15	VV								
240703	6B	15	IC								
240801	6B	5.3	IC	45	C	13:52	14:17	0.9	3.2	25	60
240802	6B	5.3	VV								
240803	6B	5.3/10	IC	45	C	14:19	14:30	0.95	3.1	24	60
240804	6B	10	VV								
240805	6B	10.15	IC	45	C	14:39	15:22	1.0	3.1	23	60
240806	6B	15	VV								
240901	6B	5.3	IC	65	C	15:30	16:00	1.05	3.1	22.5	55°
240902	6B	5.3	VV								
240903	6B	5.3/10	IC								
240904	6B	10	VV	65	C	16:00	16:20	1.10	3.1	22.0	50
240905	7A	10	VV	65	C	16:21	17:05	1.10	3.1	22.0	50
240906	7A	10.15	IC								
240907	7A	15	VV	65	C	17:08	18:02	1.05	3.1	19.5	50

DATE: Jan 24, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
								Air	Coast		
240907	7A	15	VV	65	C	17:08	18:02	1.05	3.1	19.5	50
240908	7A	15	IC								
240901	7A	5.3	IC								
240902	7A	5.3	VV	65	D	19:09	19:42	1.10	3.3	15	40
241003	7B	5.3	IC								
241004	7B	5.3, 10	IC								
241005	7B	10	VV	65	D	19:54	20:55	1.20	3.45	14.5	45
241006	7B	10, 15	IC								
241007	7B	10	VV	65	D	21:07	21:42	0.9	3.4	16.5	40
241008	7B	10, 15	IC								
241009	7B	15	VV	65	D	21:44	22:27	0.8	3.4	17	40

DATE: Jan 25, 1964

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (knots)	WIND DIRECTION (deg)
								Air	water		
250002	8A	5.3	IC			10:34	11:02	1.6	0.1	18	360
250003	8A	5.3	VV	55	D						
250004	8A	5.3	IC								
250005	8A	10	IC			11:06	11:28	4.8	3.1	28	360
250006	8A	10	VV	55	D						
250007	8A	10	IC								
250101	8A	15	IC			12:30	12:55	4.8	3.2	18	340
250102	8A	15	VV	55	D						
250201	8A	15	IC								
250301	8A	5.3	IC			13:28	13:58	4.9	3.4	14	360
250302	8A	5.3	VV	55	C						
250401	8A	5.3	IC								
250402	8A	10	IC	55	C	14:02	14:20	1.0	3.2	14	360
250403	8A	10	VV								
250404	8A	10	IC								
250405	8A	15	IC								
250406	8B	15	IC								
250407	8B	15	VV	55	C	14:21	14:43	1.0	3.7	17	360
250408	8B	15	IC								

DATE: Jan 25, 1984

IC: Interval calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO.	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
								Air	Water		
250409	8B	5.3	IC	55	U	15:41	16:11	1.5	3.7	16	300
250410	8B	5.3	VV								
250411	8B	5.3	IC								
250412	8B	10	IC	55	U	16:16	16:37	1.5	3.7	16	300
250413	8B	10	VV								
250414	8B	10	IC								
250415	8B	15	IC	55	U	16:43	17:13	1.9	3.6	18	310
250416	8B	15	VV								
250417	8B	15.0	IC								
250501	8B	5.3	IC	65	U	17:33	17:53	1.8	3.4	16	310
250502	8B	5.3	VV								
250504	8B	FE53	IC								
250505	9A	10	IC	65	U	18:02	18:33	1.8	3.4	16	310
250506	9A	10	VV								
250507	9A	10	IC								
250508	9A	15	IC								
250509	9A	15	VV	65	U	18:40	19:02	2.0	3.1	14	320
250600	9A	4.5	IC								

DATE: Jan 25, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
								Air	Water		
250701	90	5.3	IC								
250702	90	5.3	VV	65	U	22:51	22:14	1.8	3.1	6	270
250703	90	5.3	VV	65	U	22:15	22:18	1.8	3.1	6	270
250704	90	5.3	IC								
250705	90	10	IC		U	22:19	22:38	1.8	3.0	5.5	260
250706	90	10	VV	65							
250707	90	10	IC								
250708	90	15	IC		U	22:42	23:03	1.8	3.0	5.0	250
250709	90	15	VV	65							
250710	90	15	IC								

DATE: Jan 26, 1954

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO.	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (knots)	WIND DIRECTION (deg)
								Air	Water		
260001	98	5.3	IC								
260002	"	"	VV	45°	U	5:25	5:51	13	13.6	30	
260003	"	"	IC								
260004	10A	10	IC								
260005	"	"	VV	45°	U	5:58	7:29	13	13.2	27	
260006	"	"	IC								
260007	"	15	IC								
260008	"	"	VV	45°	U	7:30	8:00	16	29	28	
260009	"	"	IC								
260010	"	45-7.7	IC								
260011	"	"	VV	45°	U	8:10	10:40	16	27	24	
260012	"	40-17.0	IC								
260013	"	90-17.0	VV	45°	U	10:46	11:16	16	27	26	
260014	"	"	IC								
260015	10B	5.3	IC								
260016	"	"	VV	55°	U	11:38	12:08	13	29	28	
260017	"	"	IC								

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

[illegible]

DATE: Jan 27, 1984

YC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

[illegible]

DATE: Jan. 27, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO.	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
								Air	Water		
270914	13B	45-7.7	HH	65°	U	17:09	17:55	1.7	4.1	32	
270915	"	"	IC								
271001	"	40-18.0									
271003	"	"	HH	65°	U	19:07	19:53	2.2	4.2	14	
271004	"	"	IC								
271101	"	50-5.3	IC								
271103	"	5.3	HH	55°	U	20:14	20:34	2.4	4.1	19	
271104	"	"	IC								
271105	14A	10	IC	55°	U	20:42	21:14	2.3	4.1	18	
271106	"	"	HH								
271107	"	"	IC								
271109	"	15	IC								
271110	"	"	HH	55°	U	21:18	21:49	2.3	4.1	17	
271111	"	"	IC								
271112	"	45-7.7	IC								
271113	"	"	HH	55°	U	21:56	22:42	2.3	4.1	18	
271114	"	"	IC								
271115	"	90-18.0	HH	55°	U	22:40	23:01	2.1	4.2	10	
271116	"	"	HH	55°	U						

DATE: Jan 27, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO.	FREQ GHZ	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
								Air	Water		
271118	148	40-18.4	HH	55°	U	23:06	13:37	2.1	4.2	17	
271119	"	"	IC								

DATE: Jan 28, 1964

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO.	FREQ GHz	POL	ANGLE OF INC (deg)	LOOK DIREC-TION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECT-ION (deg)
								Air	Water		
280001	14B	5.3	TC	55°	U	7:57	8:40	2.0	4.2	18	
280002	"	"	HH	55°	U	8:51	9:27	2.4	4.2	17	
280001	"	"	IC	55°	U	9:31	9:53	2.3	4.2	16	
280102	"	"	HH	55°	U	10:05	10:30	2.5	4.2	16	
280103	"	5.3, 10	IC	55°	U	10:35	10:46	2.6	4.2	16	
280104	"	10	HH	55°	U	10:53	11:06	2.6	4.2	17	
280105	15A	"	IC	55°	U	11:07	11:17	2.6	4.2	17	
280106	"	"	HH	55°	U	11:20	11:52	2.6	4.2	16	
280107	"	"	IC	55°	U						
280201	"	5.3	IC	55°	C						
280202	"	"	VV	55°	C						
280203	"	"	"	63°	C						
280204	"	"	"	44°	C						
280205	"	"	"	54°	C						
280206	"	"	IC	54°	C						

Average flight

DATE: Jan. 28, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO.	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME		END TIME	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
						H : M	H : M		Air	Water		
280301	15A	5.3	IC	•								
280302	"	"	VV	55°	C							
280303	"	"	IC	•								
280304	"	"	VV	18°	C							
280305	15B	"	IC	•								
280306	"	"	VV	18°	C	12:14	12:25		2.6	4.2	15	
280307	"	"	VV	26°	C	12:30	12:48		2.6	4.2	14	
280308	"	"	IC	•								
280309	"	"	VV	35°	C	12:49	13:07		2.6	4.2	14	
280310	"	"	"	45°	C	13:12	13:27		3.0	4.2	14	
280311	"	"	"	55°	C	13:31	13:45		3.2	4.2	13	
280312	"	"	"	65°	C	13:50	14:06		3.3	4.2	13	
280313	"	"	IC	•								
280314	"	"	VV	65°	C	14:07	14:28		3.2	4.2	13	
280315	"	"	VV	70°	C	14:30	14:45		3.2	4.2	14	
280317	16A	"	IC	•								
280318	"	"	VV	73°	C	14:56	15:03		3.2	4.2	15	

Aircor Air

DATE: Jan 26, 1964

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
								Air	Water		
280401	16A	10	IC	•		15:38	15:49	3.1	4.2	15	
280402	"	"	VV	73°	C						
280403	"	"	IC								
280404	"	15	IC								
280405	"	"	VV	73°	C	15:51	16:03	3.1	4.2	15	
280406	"	10	VV	68°	C	16:10	16:20	3.1	4.2	15	
280407	"	15	VV	68°	C	16:22	16:32	3.0	4.2	15	
280408	"	"	IC								
280409	"	10	IC	57°	C	16:38	16:48	2.9	4.2	15	
280410	"	10	VV								
280411	"	15	VV	57°	C	16:49	16:59	2.8	4.2	15	
280412	"	10	VV	45°	C	17:11	17:21	2.7	4.2	15	
280413	"	10	IC								
280501	"	15	IC								
280502	"	"	VV	45°	C	17:27	17:37	2.6	4.2	16	

DATE: Jan. 28, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO.	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIREC-TION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
								air	water		
280503	16A	15	IC	.							
280504	"	10	IC								
280505	"	"	VV	35°	C	17:44	17:52	26	42	16	
280506	"	15	VV	35°	C	17:53	18:00	24	42	16	
280601	"	10	IC								
280602	"	"	VV	25°	C	19:44	19:52	26	42	17	
280603	"	15	IC								
280604	"	15	VV	25°	C	19:55	?	26	42	17	
280605	16B	10	IC								
280607	"	"	VV	18°	C	20:17	20:26	28	42	17	
280608	"	15	IC								
280609	"	"	VV	14°	C	20:28	20:37	30	42	16	

DATE: Jan. 29, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO.	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME		END TIME		TEMPERATURE		WIND SPEED (knots)	WIND DIRECTION (deg)	
						H	M	H	M	Air	Water			
290001	168	5.3	IC	55°	Up	10:30	11:19			3.9	4.0	18		290001
290002	"	"	VV											"
290003	"	"	IC											"
290101	"	"	IC											"
290102	"	"	VV	55°	Up	12:40	13:40			3.8	4.0	79		"
290103	17A	"	IC											"
290104	"	"	VV	55°	U	13:50	15:01			4.4	4.9	241		"
290105	"	"	IC											"
290201	"	90-18.0	IC											"
290202	"	"	VV											"
290205	"	45-7.7	IC											"
290206	"	"	VV											"

Sphere Calibration.
Started at 5:40 PM.

DATE: Jan 30, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: up wind

RUN NO.	TAPE NO.	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
								air	water		
300020	18A	15	IC	45°	U	15:21	15:54	4.3	4.0	29	
300021	"	"	HH								
300022	"	"	IC								
300023	"	45-77	IC	45°	U	15:58	16:24	4.4	4.0	29	
300025	"	"	HH								
300027	18B	"	IC	45°	U	16:30	17:00	4.5	4.1	20	
300028	"	"	HH								
300029	"	"	IC								
300030	"	90-18.0	IC	45°	U	17:11	17:58	4.6	4.1	19	
300031	"	"	HH								
300032	"	"	IC								
3000201	"	5.3	IC	35°	U	19:10	19:22	4.7	4.1	20	
3000202	"	"	HH								
3000203	"	"	IC								
3000204	"	10	IC	35°	U	19:23	19:54	4.6	4.1	20	
3000205	"	"	HH								
3000206	"	15	IC	35°	U	19:35	19:45	4.6	4.1	22	
3000207	"	"	HH								
3000208	"	"	IC								

DATE: Jan 30, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: up wind

RUN NO.	TAPE NO	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
							Air	Water		
300210	18B	5.3	IC	25°	U	19:55	4.6	4.1	22	
300211	"	"	HH							
300212	"	"	IC							
300214	19A	10	IC							
300215	"	"	HH	25°	U	20:09	4.6	4.1	22	
300216	"	"	IC							
300217	"	15	IC							
300218	"	"	HH	25°	U	20:22	4.6	4.0	23	
300219	"	"	IC							

DATE: Jan 31, 1984

IC: Interhal calibration

C: Cross wind, D: Down wind, U: up wind

RUN NO.	TAPE NO	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIREC-TION	START TIME H : M		END TIME H : M		TEMPERATURE C		WIND SPEED (knots)	WIND DIRECTION (deg)
										Az	Uz		
31001	20A	5.3	IC	18°	C	10:48		11:20		3.7	3.9	30	Arrow 180 deg
310101	"	"	VV										
310102	"	"	IC										
310103	"	"	VV	25°	C	11:28		11:57		3.7	3.9	30	"
310104	"	"	IC										
310105	"	"	IC										
310106	"	"	VV	35°	C	12:00		12:25		3.7	3.9	37	"
310107	"	"	IC										
310108	"	"	VV	45°	C	12:34		13:06		3.6	3.9	357	"
310109	"	"	IC										
310110	"	"	VV	55°	C	13:07		13:13		3.6	3.9	37	"
310111	20B	"	VV	55°	C	13:15		13:46		3.8	3.9	37	Arrow 180 deg
310112	"	"	IC										
310113	"	"	VV	64°	C	13:46		13:58		4.1	3.9	32	
310114	"	"	IC										
310115	"	"	VV	72°	C	13:59		14:12		4.1	3.9	30	
310116	"	"	IC										
310117	"	"	IC										
310118	"	"	VV	25°	C	14:21		14:33		4.4	3.9	30	

DATE: Jan 31, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO	FREQ GHz	POL	ANGLE OF INC (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (knots)	WIND DIRECTION (deg)	
								Air	Water			
310119	208	5.3	VV	18°	C	14:31	14:45	4.6	3.9	26		
310120	"	"	IC									
310121	"	"	IC									
310122	"	"	VV	55°	U	14:55	15:46	4.9	3.9	26		
310123	"	"	IC									
310124	19A (Remaining portion of tape #19)	IC 10	IC									
310125	1100	10	VV	55°	U	16:02	16:34	5.1	3.9	24		
310126	"	10	VV	55°	U	16:36	?	4.9	3.9	24		
310127	"	15	IC	55°								
310128	"	5.3	IC	55°								
310129	"	"	HH	55°		17:42	17:50	5.0	3.8	25		
310131	"	"	IC	55°								
310132	"	"	HH	55°		17:54	18:21	5.0	3.8	25		
310133	19B	15	IC	55°								
310134	"	15	HH	55°		18:43	19:06	4.9	3.8	28		
310135	"	15	IC	55°								
310201	"	"	HH	55°		19:43	20:25	4.9	3.8	31		
310202	"	"	HH	134°55'	C							

Boat in the water

DATE: Jan 31, 1964

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO.	FREQ GHZ	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
								Air	Water		
310203	19B	15	IC	•							
310204	"	5.3	IC	45°	C	20:41	21:15	4.4	3.8	31	
310205	"	"	HH								
310206	"	"	IC								
310207	"	10	IC	45°	C	21:17	21:41	4.6	3.8	30	
310208	"	"	HH								
310209	"	"	IC								
310210	"	15	IC	45°	C	21:46	21:52	4.8	3.8	30	
310211	"	"	HH								
310212	21A	15	IC								
310213	"	"	HH	45°	C	21:55	22:26	4.8	3.7	30	
310214	"	"	IC								

DATE: Feb 1, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: up wind

RUN NO.	TAPE NO	FREQ GHZ	POL	ANGLE OF INC. (deg)	LOOK DIREC-TION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)	
								A. 2	66721			
010002	21A	5.3	IC									Altitude (ft)
010003	"	"	IC									(Long) (lat)
010004	"	"	VV	18°	U	10:37	11:05	3.6	3.5	23		
010005	"	"	IC									
010006	"	"	VV	24°	U	11:10	11:36	3.1	3.5	23		
010007	"	"	IC									Altitude (ft)
010008	"	"	IC									(Long) (lat)
010009	"	"	VV	55°	U	11:59	12:53	2.4	3.5	22		
010010	21B	"	VV	55°	U	12:55	15:23	2.0	3.5	20		
010011	22A	"	IC	55°	U	12:55	13:33					
010013	"	10	IC	55°	U	15:28	15:52	1.7	3.6	16		
010014	"	"	VV									
010015	"	"	IC									
010016	"	15	IC									
010017	"	"	VV	55°	U	16:02	16:26	1.7	3.6	15		
010018	"	5.3	IC									
010019	"	"	VV	55°	U	16:29	17:08	2.0	3.6	20		
010020	"	"	IC									
010021	"	"	IC									
010022	"	"	HH	55°	U	17:18	17:22	2.1	3.6	22		

DATE: Feb 1, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO.	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (knots)	WIND DIRECTION (deg)
								Air	Water		
010023	22A	5.3	HH	55°	U	17:24	17:41	2.2	3.6	22	
010024	"	"	IC								
010025	"	10	IC								
010026	"	"	HH	55°	U	17:45	?	2.3	3.7	23	
010028	22B	"	IC								
010029	"	15	IC								
010030	"	"	HH	55°	U	18:05	18:41	1.6	3.7	23	
010031	"	"	IC								
010032	"	5.3	IC								
010033	"	"	IC	54°	C	19:14	19:47	1.3	3.7	24	
010034	"	"	VV								
010035	"	10	IC								
010036	"	"	VV	54°	C	19:49	20:21	1.3	3.7	27	
010037	"	"	IC								
010038	"	15	IC								
010039	"	"	VV	54°	C	20:23	20:48	0.9	3.7	29	
010040	"	"	IC								

DATE: Feb 1, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (knots)	WIND DIRECTION (deg)
								Air	Water		
010041	23A	53	IC								
010042	"	"	HH	54°	C	21:06	21:26	0.7	3.7	30	
010043	"	"	IC								
010044	"	10	IC								
010045	"	"	HH	54°	C	21:28	22:10	0.6	3.5	31	
010046	"	"	IC								
010047	"	15	IC								
010048	"	"	HH	54°	C	22:28	23:00	1.1	3.5	31	
010050	"	"	IC								

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

[illegible]

DATE: Feb 2, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: Up wind

RUN NO.	TAPE NO	FREQ GHZ	POL	ANGLE OF INC (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
								Wet	Dry		
020017	24A	5.3	IC	55°	U	11:35	12:52	3.2	3.6	28	
020018	"	"	VV	55°							
020019	"	"	IC								
020020	"	10	IC								
020021	"	"	VV	55°	U	12:54	13:15	3.2	3.5	26	
020023	24B	"	IC								
020024	"	15	IC								
020025	"	"	VV	55°	U	13:24	13:54	3.8	3.5	24	
020026	"	"	IC								
020027	"	5.3	IC	55°							
020028	"	"	VV	55°	U	14:32	15:23	4.4	3.5	16	
020029	"	"	IC								
020030	"	5.3	IC	55°							
020031	"	"	HH	55°	U	15:32	15:34	4.6	3.5	16	
020032	"	10	IC								
020033	"	10	HH	55°	U	15:35	15:44	4.7	3.5	16	
020034	"	15	IC								

DATE: Feb 3, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: up wind

RUN NO.	TAPE NO.	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIRECTION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (deg)
								Air	Water		
030215	240	10	IC	•							
030216	"	10	HH	45°	U	01:55	01:04	44	3.5	16	
030217	"	15	IC								
030218	"	"	HH	45°	U	01:08	01:23	44	3.5	16	
030219	"	"	IC								
030220	"	"	VV	45°	U	01:29	02:00	46	3.5	18	
030221	"	"	IC								
030222	"	10	IC	45°	U	01:02	02:37	46	3.5	17	
030223	"	"	VV								
030224	"	"	IC								
030225	"	5.3	IC	45°	U	02:40	03:10	45	3.5	16	
030226	"	5.3	VV								
030227	"	"	IC								

DATE: Feb 2, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: up wind

RUN NO.	TAPE NO.	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIREC-TION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (Knots)	WIND DIRECTION (any)
								Air	Water		
020101	24B	5.3	IC	55°	U	16:23	16:56	4.8	3.5	19	
020102	"	"	VV								
020103	"	"	IC								
020104	"	"	IC								
020105	25A	9.0-18.0	IC	55°	U	17:01	18:01	4.8	3.6	19	
020106	"	"	VV								
020107	"	"	IC								
020201	"	4.5-7.7	IC	55°	U	18:38	19:44	4.7	3.6	21	
020204	"	"	VV								
020205	25B	"	IC	55°	U	19:57	22:05	4.8	3.6	16	
020206	"	5.3	VV								
020207	"	"	IC								
020208	26A	10	IC	55°	U	22:05	23:28	4.5	3.5	19	
020209	"	"	VV								
020210	"	10.15	IC	55°	U	23:30	00:20 (663)	4.3	3.5	18	
020211	"	15	VV								
030212	26B	15	IC	55°	U	00:52	00:54	4.4	3.5	16	
030213	"	5.3	IC	45°	U						
030214	"	"	///								

Buynet Point

DATE: Feb 3, 1984

IC: Internal calibration

C: Cross wind, D: Down wind, U: up wind

RUN NO.	TAPE NO	FREQ GHz	POL	ANGLE OF INC. (deg)	LOOK DIREC-TION	START TIME H : M	END TIME H : M	TEMPERATURE C		WIND SPEED (knots)	WIND DIRECT-ION (deg)
								Air	Water		
030303	27A	5.3	IC	.	.						
030304	"	"	VV	18°	U	9:41	10:43	44	34	24	
030305	"	"	LC								
030306	"	"	VV	25°	U	10:45	11:14	44	34	26	
030307	"	"	IC								
030308	"	"	VV	35°	U	11:17	11:45	41	34	25	
030309	"	"	IC								
030310	"	"	VV	45°	U	11:48	12:03	41	34	24	
030311	"	"	IC								
030312	"	"	VV	55°	U	12:06	13:12	35	34	30	
030313	"	"	IC								

Arrived 11:15

END

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7-84